

Compressor Motor Specification

Turbo Air® 6000 Centrifugal Compressor

- ## 2.0 PERFORMANCE

- 2.6 Acceleration Times: Minimum 4 Seconds
 Maximum at Full Volt. 15 Seconds
 at 65% Volt. 30 Seconds

Note: Motors designed for reduced voltage starting are not required to meet full voltage acceleration criteria.

- 2.7 Insulation Class F or better and Temperature Rise at 40°C:
 Random wound 1.0 S.F. motor 80°C rise Measured by resistance.
 Random wound 1.15 S.F. motor 90°C rise Measured by resistance at SF.
 Form wound 1.0 S.F. motor 80°C rise Measured by resistance.
 Form wound 1.15 S.F. motor 105°C rise Measured by resistance at SF.

3.0 GENERAL REQUIREMENTS

- 3.1 Standards:
 The motor is to be designed to conform to specifications detailed in NEMA MG-1 unless otherwise stated. CE mark may be required for scope, see Bill-of-Materials for requirement.
- 3.2 Shaft Currents:
 The manufacturer must insure bearing integrity from the harmful effects of stray shaft currents. If special handling is required, explanatory notes are to be included on proper engineering documentation.
- 3.3 Rotor Bars:
 Aluminum rotor bars are standard. When specified, rotor is to be fabricated with copper bars.
- 3.4 Criticals:
 The rotor's first critical speed is to be a minimum of 120% of operating speed or below 80% of operating speed.
- 3.5 Rotor Balance:
 The residual unbalance is defined as the amount of unbalance remaining in a rotor after it has been dynamically balanced. Its units are ounce-inches or gram-inches. Balancing is to be performed with a full half-key installed.

The maximum allowable residual unbalance per balance plane shall be:

$$U = (4W) N$$

where,

U = residual unbalance in ounce-inches,
 W = journal static load * in pounds, and
 N = rotor operating speed in RPM.

Rotor Balance (cont.):

***Note:** If actual static weight load on each journal is unknown, assume the total rotor weight is equally supported by the bearings.

The rotor's double amplitude (peak-to-peak) vibration level is limited to the following values. The motor must be operating at rated speed, unloaded, bolted or clamped to the test plate.

Method / Location	Inches	µm
• Accelerometers on the bearing housing: (Vertical/Horizontal)	0.0005	13
(Axial)	0.0004	10
• Proximity probes or stick on the shaft	0.0010	25

3.6 Noise Standard:

The overall unloaded sound-pressure level shall not exceed 90 dBA when measured at four locations around the motor (front, back, two sides). Measurements are to be made at shaft level, one meter (3 feet) from the outer most surface of the stator housing.

3.7 Engineering Documentation:

Documentation will be accepted electronically in PDF and DXF/DWG format. A 3D CAD model with proprietary info removed is preferred (format: .x_t, .x_b, .stp, .step) along with the outline PDF. When possible, a 3D solid model should be submitted for inclusion in the end user's drawings. Operator's manuals are to be included with submission or linking information to vendor website allowing for download of the manual.

The following shall be submitted within four weeks of receipt of order:

- Motor Data Sheet
- Performance Curves: speed versus torque & current, and speed versus time.
- Outline Drawing detailing:
 - Direction of rotation.
 - Accessory items including connection diagrams.
When monitoring instruments are supplied, alarm and trip set points (ex.: temperature and vibration limits) must be shown on the motor data or drawing.
 - Terminal box details including dimensions and connection size.
 - Indication if terminal box is shipped loose.
 - Size and number of stator leads.
- Connection Diagram

The following shall be submitted at time of motor shipment:

- Final Test Data

3.8 Paint Requirement:

Unless otherwise stated on the Bill of Materials, the vendors standard paint color is acceptable for all motors shipping to Ingersoll Rand's Buffalo, New York address.

Motors shipping to any other address shall be painted the Ingersoll Rand standard paint color, RAL#6011 ("Reseda Green", Munsell# 10GY5/4).

Painting method is to be suitable for outdoor applications, 2.8 to 3.2 mils thick.

4.0 MECHANICAL ARRANGEMENT

4.1 Rotation:

The rotation of the motor is to be counter-clockwise (CCW) when viewed from opposite the drive end (ODE). Direction arrow nameplate must be permanently affixed to the motor housing above the shaft.

4.2 Terminal Box:

The standard terminal box is to comply with NEMA standards for rated horsepower and voltage. If CE mark is required the terminal box is to be IEC style with removable gland plate and insulated terminals for motor connections.

The main terminal box is to be located on the left-hand side when viewed from opposite the drive end (ODE) (See F2 on Fig.1 Section 5.0). An isolation barrier must be provided around the stator leads to prevent hot motor exhaust air from entering the box.

The terminal box base (not the removable cover) is to contain a plugged hole (0.5" NPT) to permit electrical conduit entry for current transducer. The hole is to be located on the drive end side, near the bottom of the box

When terminal boxes are shipped loose from the motor, a separate name tag shall be affixed to the terminal box stating, "Terminal box for [part number]".

See section 5.0 for dimensional restrictions. Terminal boxes that are not self supporting must be noted on the drawing with approximate weight and footprint requirement for support foundation.

4.3 Stator Leads:

- For NEMA terminal boxes: Leads are to extend a minimum of 24" (60 cm) beyond the lead entry to the terminal box. Appropriately sized lugs are to be permanently attached to the ends of the leads.
- For IEC terminal boxes: Land leads at insulators in terminal box, extended leads are not required.

4.4 Bearing Requirements:

The motor is to be equipped with the manufacturers standard bearings.

4.5 Bearing Insulation:

If there is potential for damage from stray shaft current, the opposite-drive end (ODE) bearing only is to be insulated. Any instrumentation or oil piping that might interrupt the bearing insulation must also be properly insulated. A note with any special concerns about bearing insulation must appear on the motor outline drawing.

4.6 Bearing Lubrication:

Ball bearings are to be grease-lubed. Proper connections are to be provided to allow for regreasing without disassembly. Grease reliefs shall be provided.

Sleeve bearings are to be oil-ring lubed, as standard. When specified on the contract Bill-of-Material, sleeve bearings may receive direct feed lubrication from the compressor system. This is in addition to the oil-rings. High quality turbine oil is delivered as follows:

Units	English	Metric
Viscosity	200 SSU @ 100°F	43 mm ² /s(=cSt)@40°C
Pressure	20 psig	1.4 barg
Temperature	120°F	50°C

Connections for feed and drain are to be provided in the bearing housings by the motor manufacturer. Orifices to regulate flow and pressure are to be provided in the feed connection. The drain connections are to be designed to maintain oil level for proper oil-ring lubrication. Connections are to be located on the right hand side of the motor, viewed from opposite drive end. Pipe fittings are to be forged steel, or stainless (when specified). Connection locations are to be shown on the outline drawing. Connection sizes are to be as follows: Drain – 1-1/4" NPT, female; Feed – 1/2" NPT, female.

4.7 Gaskets:

All gaskets are to be free of asbestos fibers, but must exhibit similar endurance to high temperatures, water, steam, inert gases, lube oils and other petroleum products without loss of mechanical properties.

4.8 Rotor End Float:

Bearing Type	Minimum	Maximum
Ball	0.020" (0.5 mm)	0.110" (2.8 mm)
Sleeve	0.440" (11.0 mm)	0.570" (14.5 mm)

4.9 Motor Nameplate:

As a minimum, the motor nameplate shall include horsepower, voltage, frequency, service factor, full load current, current at service factor, lubricant type, lubrication frequency when applicable and the Ingersoll Rand part number.

If CE mark is required the nameplate shall also include the rated horsepower in kW.

Advertising nameplates must be deleted as they will be removed.

4.10 Connection Diagram Nameplate:

When more than three independent stator leads are provided, a connection diagram nameplate specific to the motor being supplied must be permanently attached to the housing. General, or multiple choice, diagrams are not acceptable.

4.11 Mounting Holes:

The mounting bolt area shall be free of obstructions and have sufficient clearance to allow easy installation and removal of hold-down bolts with standard tools.

4.12 Rotor Shaft:

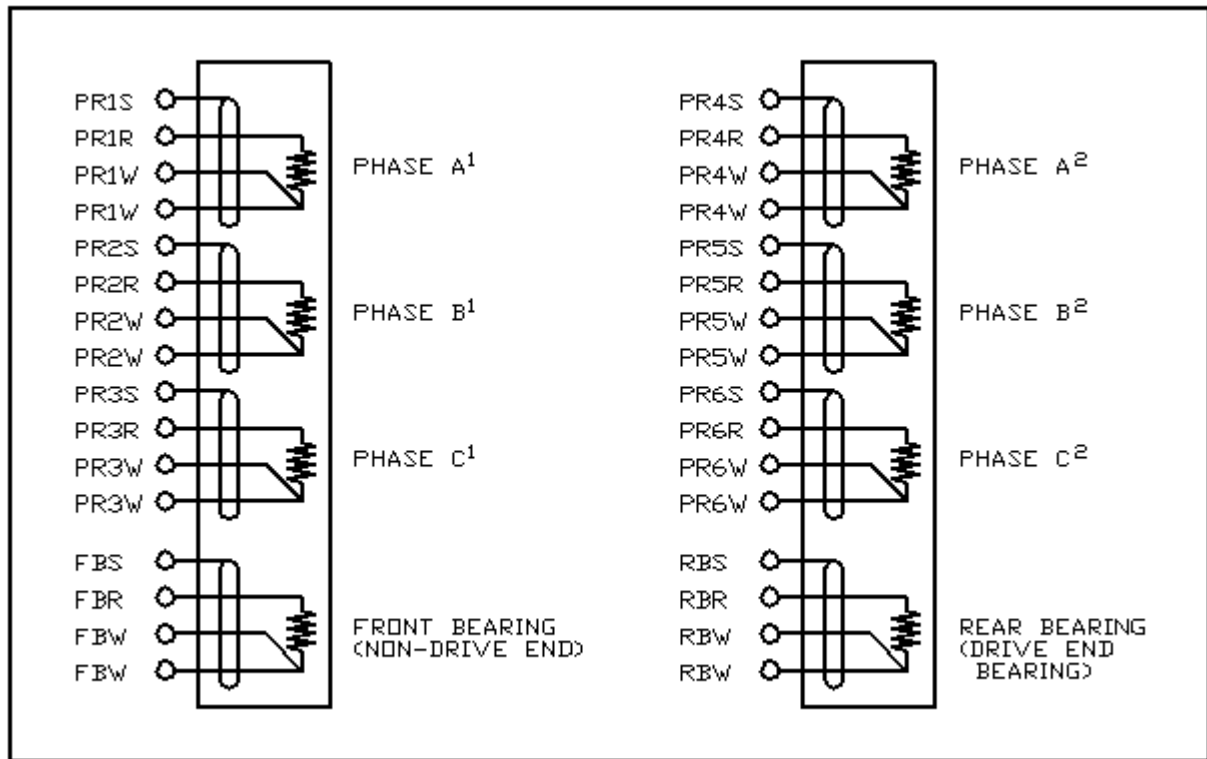
The machining center on the drive end shall not exceed 1.125" (28 mm) in diameter. This is to facilitate buttons used to limit end-float in some couplings.

4.13 Coupling Key:

A key is to be provided for the full length of the keyway. The axial length of the coupling to be used is 4.13" (105 mm). If the keyway extends beyond the coupling, a stepped key is required.

4.14 Temperature Instrumentation:

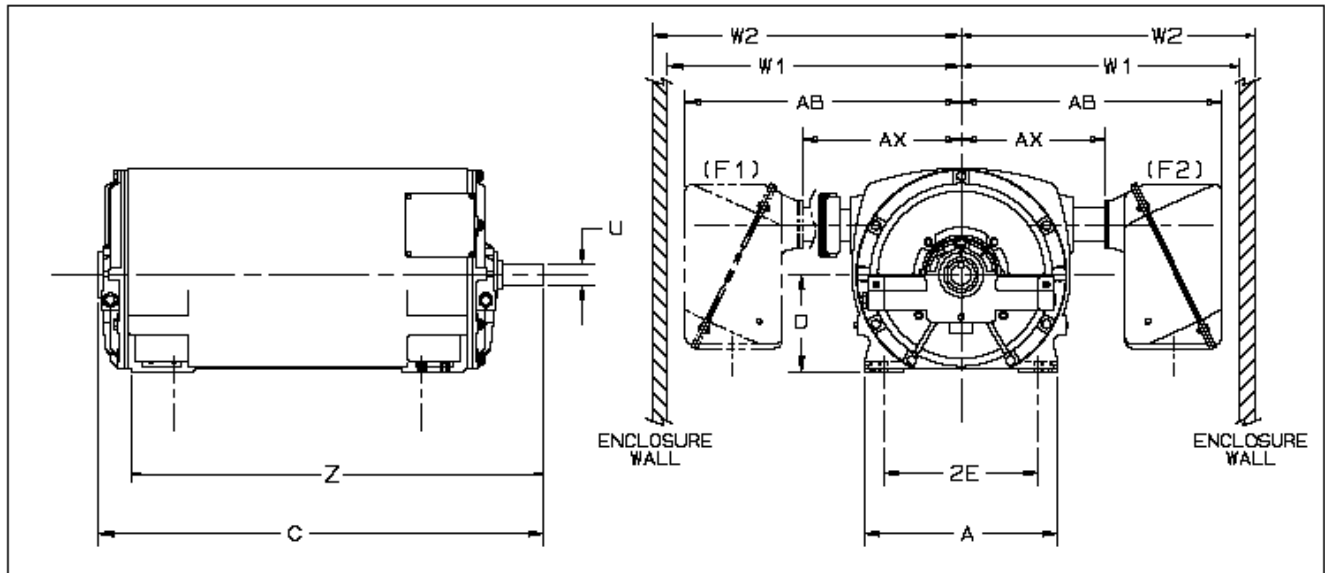
- When specified on the contract Bill-of-Material, all stator and/or bearing RTD's are to be 3-wire, 100-ohm platinum with a TRC of 0.00385.
- RTD wires are to be shielded, with the shield individually landed as shown below.
- RTD's are to be wired to terminal strips in an appropriately sized auxiliary terminal box. Preferred labeling of terminal strips is shown below.



- Bearing RTD's supplied with individual terminal enclosures must be terminated in the above terminal box. The motor supplier is to provide suitable conduit between the terminal points.
- The RTD terminal box base (not the removable cover) is to contain a plugged hole (1" NPT) to permit electrical conduit entry. The hole is to be located on the bottom or drive-end side of the box.

5.0 DIMENSIONAL RESTRICTIONS

Major dimensional limits are categorized below. Consult the factory on the acceptability of variations.



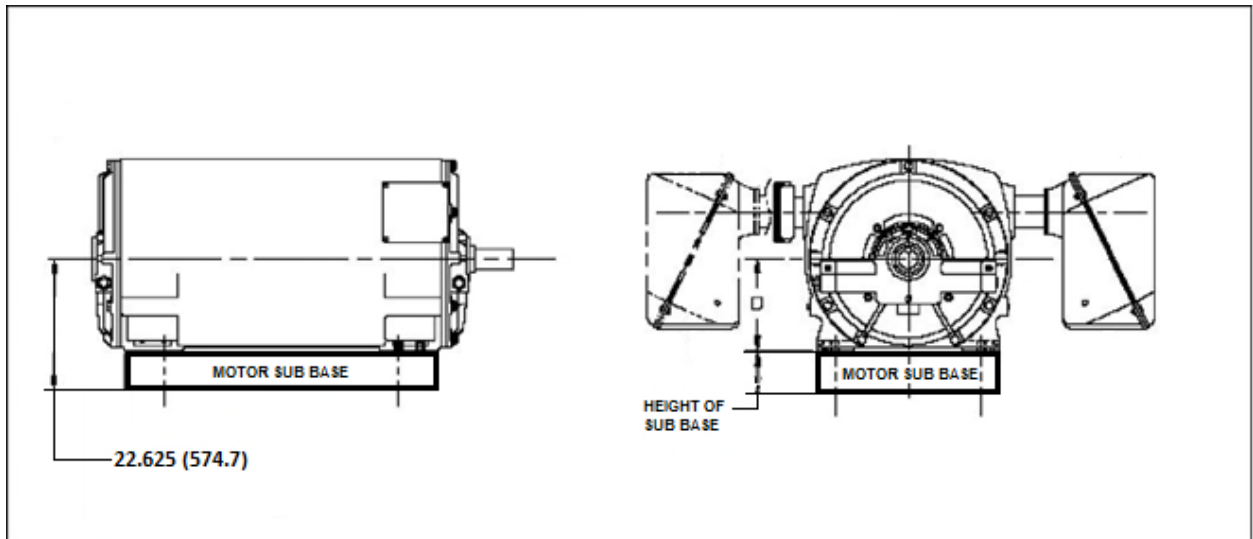
Model		C*	D	2E	A	Z	U	KEY
Turbo Air 6000		105 (2667)	20 (508)	32 (813)	40 (1016)	83 (2108)	4.00 (102)	1.00 (25.4)
AB/AX		W1	W2			W1	W2	
SEE BELOW	With enclosure and F2 terminal box	40.50 (1029)	44.00 (1118)		With enclosure and F1 terminal box	37.50 (953)	40.00 (1016)	

* Dimension C applies to ODP frames when enclosed, for others dimension is 116 (2946)

All dimensions are given in inches (mm).

- 5.1 For motors with enclosure requirements, as stated in the Bill-of-Material, dimension AB should be less than W1. If this is not possible then dimension AX should be greater than W2.
- 5.2 Weight Limits:
The total weight of the motor for a standard compressor package shall not exceed 8000 pounds (3600 Kg). Motors in excess of that weight may be accommodated with modifications to supporting structures. Consult factory for approval of such motors.

- 5.3 For motors that require longitudinal support, the motor manufacturer must provide a sub-base with a machined mounting surface where the height of the sub + the motor shaft centerline to the motor foot (dimensions D) equals 22.625" (574.7mm) $\pm 0/-0.060$ ". The motor manufacturer shall also provide full-foot motor shims, allowing shimming from 0.125" to 0.25".



Revision History:

Rev ID	ECO Number	Date	Author	Change Description
01	2360179	03/27/2009	JG/EB/TM	Initial Release
02	2374068	05/20/2009	SH	Redrawn
03	4775599	11/17/15	M Cavalieri	Update to Ingersoll Rand
04	5022961	10/15/2019	A. Hubert	Revised section 3.7 to add 3D file requests. Added section 5.3.

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